

UPPER DEVONIAN SEDIMENTS AT MT. LAMBIE, N.S.W.

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(Two Text-figures.)

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Mount Lambie, near Rydal, is generally regarded as a type area for Upper Devonian sediments in New South Wales, as the region was first examined geologically by the Rev. W. B. Clarke in 1841. Since then reports have been made by various geologists, although no very detailed map of the district has been made, other than that of C. S. Wilkinson (1875), whose estimated thickness of the sediments is frequently quoted.

Parliamentary Reports by W. B. Clarke and S. Stutchbury from 1852 onwards make reference to *Spirifer* sandstones at Mt. Lambie.

In 1875 the Department of Mines, New South Wales, published a "Geological Map of the Districts of Hartley, Bowenfels, Wallerawang and Rydal" by C. S. Wilkinson. The map is accompanied by notes and a geological section from Mt. Lambie to Mt. Walker, indicating a thickness of about 10,000 feet of Upper Devonian sediments. The notes include records of the localities of Devonian fossils, e.g., Note 11, at Solitary Creek, near the new Bathurst Road, "Thin bedded sandstones and sandy shales dip S. 35° E. at 10° full of Devonian Mollusca, Spirifera, Rhynchonella, Pecten, Orthis, Murchisonia, Modiola, Corals and Encrinure Stems". *Lepidodendron* had been discovered in January, 1875, by the Rev. W. B. Clarke (1878), "in a creek near Rydal, on a spur of the Mt. Lambie Range, where Devonian Brachiopoda occur".

Professor T. W. E. David (1893) made reference to the Upper Devonian rocks of Rydal and published a sketch-geological section from Mt. Lambie to Rydal.

Prof. David and Mr. E. F. Pittman published two papers (1893*a*, 1893*b*) on the occurrence of *Lepidodendron* at Mt. Lambie, near Rydal, noting its association with marine fossils.

These are the principal published accounts based on actual geological field-work in the area, although frequent reference to Mt. Lambie or Rydal is made elsewhere, especially with regard to the estimated thickness of 10,000 feet of Upper Devonian sediments (Sussmilch, 1914; B.A.A.S. Handbook, 1914; Benson, 1922; Encyc. Britt., 14th Ed., 1929; David, 1932, etc.).

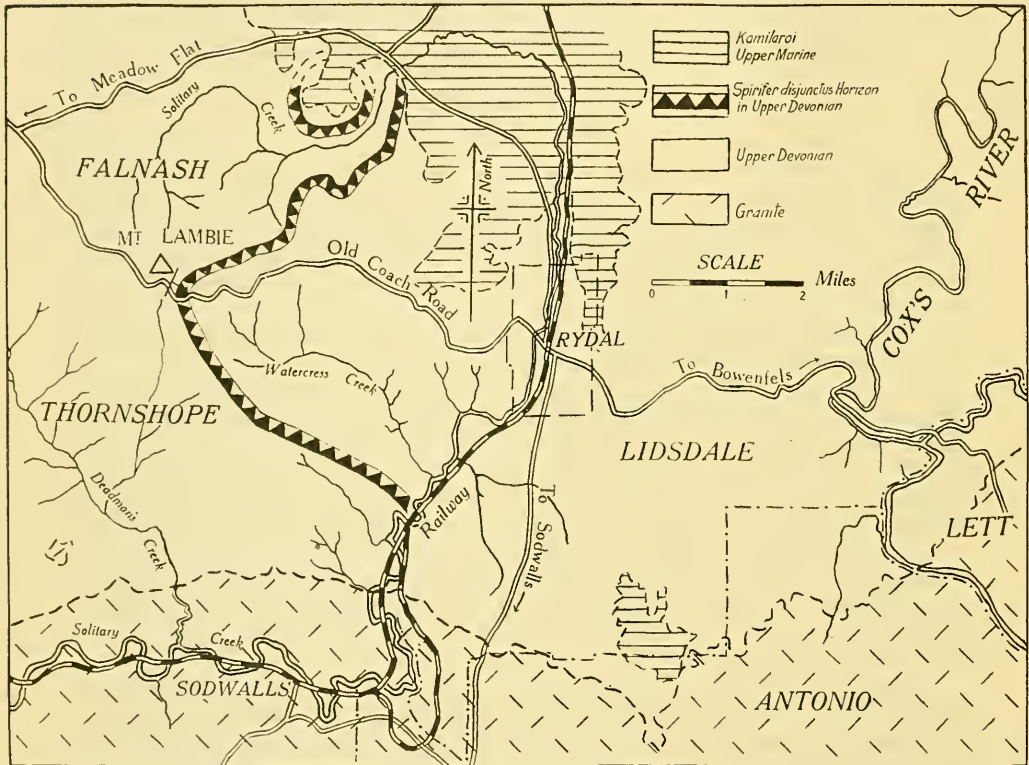
The purpose of the present paper is to place on record the results of field-investigations carried out by the writers during 1931 and 1935, particularly with regard to the geological structure and thickness of the Upper Devonian sediments.

Structure and Thickness of Devonian Beds.

Upper Devonian sediments outcrop in the vicinity of Rydal, and occur as a broad syncline with an almost meridional axis and a very slight pitch to the south. In the northern part of the area they are overlain by almost horizontally-bedded,

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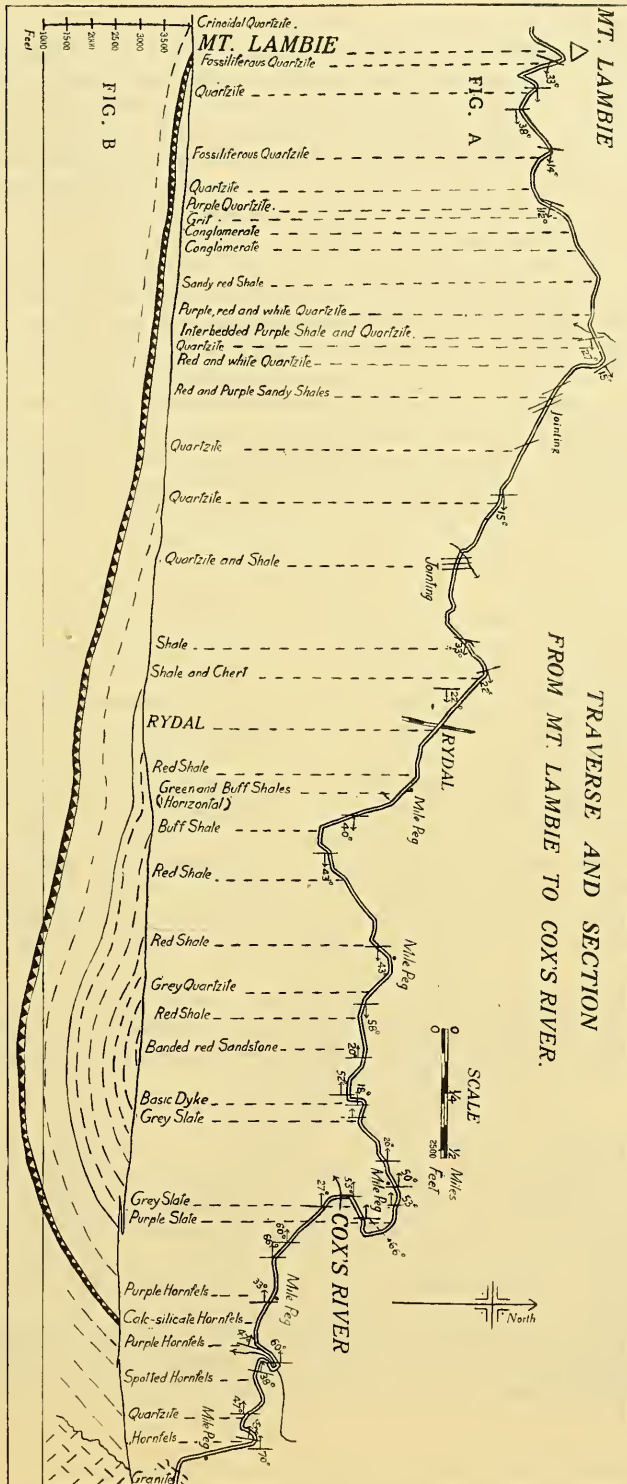
course sediments of the Upper Marine Stage of the Permian system. On the east, south and west they have been intruded by an irregular mass of granite, portion of the Bathurst-Hartley-Mt. Werong batholith. The granite boundary against the Devonian sediments was mapped in 1924 by Mr. F. Jardine, to whom we are indebted for permission to indicate this boundary on the accompanying map (Text-fig. 1).



Text-fig. 1.—Sketch-Map of Mt. Lambie-Rydal district.

The Upper Devonian sediments are essentially marine, consisting of thin-bedded conglomerates and sandstones, interbedded with fine-grained, dark red shales and mudstones. Earth movements subsequent to their deposition have induced an almost vertical cleavage in the mudstones, without affecting the more competent associated sandstones and quartzites.

Great thicknesses of the sediments are quite unfossiliferous. Close to the Mt. Lambie Trigonometrical Station, however, and stratigraphically low in the marine sequence, is a bed containing quantities of crinoid remains; a short distance to the east, and stratigraphically above, is a bed of fossiliferous quartzite about 15 inches in thickness, closely packed with internal moulds and external casts of marine forms, chiefly *Spirifer disjunctus*, *Rhynchonella pleurodon* and some lamellibranchs and gastropods. This fossil band forms a good datum horizon, which has been traced (see map, Text-fig. 1) from near the junction of the old



Text-fig. 2.—Traverse and section from Mt. Lambie to Cox's River.

and new railway lines between Sodwalls and Rydal, north-westerly towards the summit of Mt. Lambie and thence north-easterly to the road-metal quarries of Solitary Creek, near the new Bathurst Road. Circumstances prevented us from making a contour map of the area, but when due allowance is made for the physiography it is found that the outcrop of the fossiliferous horizon is that of an almost plane bed, dipping slightly south of east at an angle of only 8 degrees.

In the eastern portion of the syncline the fossiliferous horizon outcrops on the flanks of Mt. Flaherty and Mt. Walker, and dips to the west: this portion of the outcrop has not been mapped in detail.

Natural sections of the Upper Devonian sediments are rarely obtainable, although fairly good shallow sections occur in the railway and road cuttings. These sections show that the dips of the beds are not great except in the vicinity of the granite contacts. Some sections show minor folds and faults, but no major faulting has been observed. The sediments have been hornfelsed near the granite contacts and compare with similar types at Hartley. At Hartley the *Spirifer*-bearing quartzites give rise to wollastonite-quartz-hornfelses at the immediate contact and further away to calc-silicate types without wollastonite. These are usually associated with "purple-hornfelses" which appear to be the metamorphic equivalents of the intercalated red shales of Rydal (Joplin, 1935, 1936).

Text-figure 2, A, shows a detailed traverse of about nine miles along the old coach road over Mt. Lambie to Rydal and thence along the Bowenfels Road to beyond the Cox's River. The dips along the western limb of the fold are small, but those of the eastern limb are greater owing to the granite intrusion; interbedded with more competent sandstone or quartzite are bands of red shale, which in places are strongly cleaved, giving a false appearance of highly inclined strata.

Text-figure 2, B, is a vertical section across the syncline from Mt. Lambie to the Cox's River, in the direction of true dip of the beds, constructed by projecting the measurements of the dips and elevations in the traverse, figure A, on to an east-west vertical plane through Rydal. The position indicated for the fossiliferous horizon was obtained by projecting the positions of its occurrences at Solitary Creek to the north and near Sodwalls to the south on to the vertical plane (figure B) and taking a mean position. The surface dips appear to be slightly greater than the general dip of the fossiliferous horizon. The thickness of sediments above the *Spirifer* bed is thus seen to be about 2,500 feet, which we believe to be a more accurate evaluation than Wilkinson's former estimate of 10,000 feet.

It should be pointed out that underlying the sediments to the west of Mt. Lambie are fine-grained igneous rocks, which are possibly flows at the base of the Upper Devonian Lambie series. Their field-relations are obscure and, their petrology has not been critically studied.

Other Occurrences.

An investigation by one of us (I.A.B., 1931) of the Upper Devonian rocks of the South Coast of New South Wales led to a study of the distribution and occurrence of Devonian rocks throughout South-eastern Australia.

It was found that on the South Coast the Upper Devonian rocks might be divided into three stages:

(i) a lower, volcanic (Eden) stage of acid igneous rocks, 450 feet to 800 feet in thickness,

(ii) a middle (Yalwal) stage of terrestrial or estuarine sediments with interbedded contemporaneous flows of basalts and rhyolites, having a maximum thickness of 1,500 feet, and

(iii) an upper, marine stage of quartzites, grits, conglomerates and mudstones, lithologically and palaeontologically equivalent to the Upper Devonian sediments of Mt. Lambie, for which the name Lambie stage was suggested. On the South Coast sediments of this stage have a maximum thickness of 1,200 feet.

It was the apparently great variation in the thickness of the Lambie stage, constituting only the upper portion of the Upper Devonian, which led to a re-examination of the type area.

Rocks of the Lambie stage are widespread in New South Wales and have been described from many localities, including Molong-Canoblas (C. A. Sussmilch, 1906), Upper Macquarie (L. F. Harper, 1909), Forbes-Parkes (E. C. Andrews, 1910), Cobar and Canbelego (E. C. Andrews, 1913*a*, 1913*b*), Wellington (A. J. Matheson, 1930), Hartley (G. A. Joplin, 1935) and west of Molong (Joplin and Culey, 1937). Other occurrences are recorded in Reports of the Geological Survey of the Mines Department of New South Wales.

The widespread distribution of the deposits indicates a general flooding of this portion of the continent by ocean waters during late Devonian time, and whilst undoubtedly great thicknesses of sediment were laid down in some portions, it seems improbable that the thickness of the (Lambian) Upper Devonian sediments in the vicinity of Rydal was ever much greater than 2,500 feet.

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